SCIENTIFIC BOOKS

MAGNETIC WORK OF THE BRITISH NATIONAL ANTARCTIC EXPEDITION OF 1901–4

THUS far three volumes of results in geophysics have been published by the Royal Society of the fruitful Antarctic expedition under the command of Commander R. F. Scott, R.N.: Meteorology (Part I., Observations at Winter Quarters and on Sledge Journeys, with discussions by various authors); Physical Observations (tidal, gravity, seismic, auroral and ocean magnetic observations), and just recently the volume "Magnetic Observations." We shall confine our attention to the magnetic work and especially to the last volume.

In the Report on the "Physical Observations," Commander L. W. P. Chetwynd, R.N., superintendent of the Compass Department of the British Admiralty, published and discussed the results of the magnetic observations made on board the *Discovery* during her cruise, as also those obtained on land. From the various sledge journeys, he deduced for the position of the south magnetic pole in 1903, as derived from the magnetic declination results, 72° 50′ S. and 156° 20′ E.; from the observations for magnetic dip, 72° 52′ S., 156° 30′ E., hence, average position 72° 51′ S., 156° 25′ E. While these two positions agree closely, it must be stated that neither depends upon observations made at or in the vicinity of the south magnetic pole, but upon more or less complete observations some distance away. The same is to be said of the position determined by the highly successful Shackleton expedition in the beginning of 1909, viz., 72° 25′ S. and 155° 16′ E.—forty miles distant of the 1903 position; the observer (Douglas Mawson) had not quite observed a dip of 90°. Were it sufficiently important, much more elaborate observations would be required than any made by the expeditions thus far; it is, accordingly, not possible to say whether the difference between the positions for the two expeditions actually represents the secular change between 1903 and 1909.

The *Discovery* being not strictly a non-magnetic vessel, the reduction of the magnetic observations on board must have presented at times difficulties. Only results for declination and dip are published—no force observations being given, though the instrumental appliances admitted also of such work.

Auroral observations were taken chiefly by the officer of the watch whenever there were displays, the physicist and chief magnetic observer, Mr. L. C. Bernacchi, supplementing the observations on special occasions. There are worked out diurnal and monthly periodic variations, change of direction of display during simultaneous appearances with aurora borealis, sun-spots and magnetic disturbances.

The volume on "Magnetic Observations" is devoted to a discussion by the superintendent of the Kew Observatory, viz., Dr. C. Chree, F.R.S., of the magnetic observatory observations made at the *Discovery's* "Winter Quarters," May, 1902, to January, 1904, in McMurdo Sound, latitude 77° 50′.8 S. and longitude 166° 44′.8 E. The magnetograph was of the German (Eschenhagen) portable type, the absolute instruments consisting of Kew pattern magnetometers and Dover dip circles. An entirely satisfactory site for the observatory could not be obtained because of the prevalence of local magnetic disturbances due to the basic volcanic rocks consisting particularly of basalt, containing grains of magnetite; observations for standardization purposes were accordingly made out on the ice over the deep sea.

The arduous duties of observer-in-charge were performed by Mr. Bernacchi, who also assisted Dr. Chree in the reductions and discussions of the data and preparation of the results for publication. There are added at the end of the volume various reproductions of the magnetograms of special interest not only as obtained by the *Discovery's* observatory, but also at the cooperating stations: Kew, Falmouth, Mauritius, Colaba and Christchurch.

In addition to the usual tables of hourly values of the magnetic elements, of the daily, the annual and of the secular variations, and results of related analyses, Chree opportunely devotes considerable space to a discussion of magnetic disturbances of various types. In

Appendix B he furthermore makes an examination of Antarctic disturbances from October, 1902, to March, 1903, simultaneous with those discussed by Professor Kr. Birkeland in Vol. I. of "The Norwegian Aurora Polaris Expedition 1902–3." While he finds correspondences, his examination also discloses certain disagreements from the effects predicted by Birkeland, thus showing the directions in which the latter's theory requires amplification.

It is a pity that a work of such importance as the volume before us should not be better indexed or at least better arranged so that one could readily turn to any desired topic. A more liberal introduction of subsections, subdivisions, etc., would have been helpful. In the mathematical analysis it might have been better also to have followed a notation now commonly in use.

L. A. BAUER

Traité de Géographie Physique. Par E. DE MARTONNE. Paris, Armand Colin. 1909.

The present book is divided into five main parts: Notions générales, Climat, Hydrographie, Relief du Sol and Biogéographie. The reviewer does not propose to discuss the whole voluminous work, but restricts himself to the last part, the biogeographical, and a special chapter (chapter VIII.) of the fourth, namely, that on paleogeography.

A general treatise on biogeography is a hazardous undertaking at the present time; the science of the geographical distribution of the life upon the earth has undergone, during the last two decennia, such a revolution, and is still progressing at such a rapid rate, with much to be yet investigated, that we can not expect to be able to obtain a general view of the present state of our knowledge, which could be embodied as something final in a text-book.

M. de Martonne has fully realized this fact, and has avoided certain difficulties with great skill. In fact, he does not give a complete treatise of the science of biogeography according to the pattern, as laid down, for instance, by Wallace, and his book is by no means a compendium of distributional facts brought into a more or less satisfactory scheme; instead of this, he gives the general principles and laws, which govern the distribution of organisms, drawing from these the inferences with regard to the different groups of the latter, and illustrating them by selected examples.

Thus his treatment of biogeography is chiefly an account of the relations of the organic world to the physical conditions prevailing upon the earth, and might be called a general "Ecology." Three of the chapters (I., II. and IV.) are principally devoted to this side. For the rest, he discusses the distribution of plants and animals from this standpoint, dividing them into ecological classes, for which he gives the distribution upon the earth. He avoids by this, for instance by treating the different marine and terrestrial groups of animals separately, the difficulty of the association of creatures with different "habitats" into one scheme, which was the chief stumbling block of the older zoogeographers.

A very good illustration of the consequences of the author's method is seen in the map he gives for the distribution of the continental faunas (Fig. 390, on p. 852). This map differs greatly from the usual maps given for the distribution of land animals, but it is very well to keep in mind that it is not intended to represent the actual distribution of any animal, but is drawn to express, so to speak, the *possibilities of animal distribution* with relation to the distribution of the factors controlling the various types of animal life, in fact, it is an *ecological map of the continents.* For the reality of the divisions laid down upon this map examples are introduced, but, of course, only a limited space could be reserved for them.

The author insists that these relations of the organic world to their environment are of prime importance for the distribution of life upon the earth, and in this he certainly is right. But he also admits that the geographic history of the earth plays an essential part in this question. *The historical develop-*

ment of the present distribution of plants and animals, which is one of the most fascinating problems of recent biogeography, is not neglected by him. But he does not approach it from the biogeographical standpoint in so far, as he does not attempt to prove former geographical conditions by the present distribution of any organic forms, but makes it a part (chapter VIII., p. 577 ff.) of the physical geography of the land, and treats of it in connection with geological principles. His general account of the history of the continents and oceans, although given only in its main features, is rather good, and deserves attention. It rests chiefly upon the studies of the most prominent writers in this line (Suess, Lapparent, Frech, etc.).

Altogether we may say that the parts of this book discussed here are well worth reading. Difficult branches of scientific research, which are yet subject to much controversy, are represented in a lucid way, showing the cleverness and originality of the writer, and demonstrating also that he is well acquainted with the most modern phases of the questions discussed. It is hardly feasible to go into any detail, and to attempt a critical review of the special opinions of M. de Martonne, since in certain cases we would be compelled to offer evidence for the contrary, for which there is no room in these pages. We only would recommend this book to the study of all those who are interested in biogeography, ecology and paleogeography, and we have no doubt it will be a stimulus to them in their own work. These chapters are not so much a "text-book" for the beginner, giving a circumscribed amount of scientific facts to be stored away in the brain, and to be used at an "examination," but they are a challenge to the active, progressive worker in these lines, to scrutinize his own ideas, to revise them, and if they differ from those proposed here, to say so, and to bring forth the evidence, in order that they may be discussed according to their merits.

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Pittsburgh,
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Die Chemische Industrie. By G. Müller. Pp. 488. Leipzig, B. G. Teubner. 1909. Price, bound, M. 12.

This book aims to aid the merchant in his calling and to serve as a guide in trade and technical matters for chemists and others engaged in the chemical industries.

The strictly chemical aspects of the subjects here discussed are relegated to another volume, "Chemical Technics" by Dr. Heusler, which has appeared in this same Teubner "Series of Trades and Industries," to which the work here considered belongs.

The author has divided his book into two parts.

Part I. is devoted to the General Survey of Chemical Industry, and includes a discussion of its scientific and technical evolution and of the laws of trade and commerce.

In Part II. the writer takes up individually many of the more important branches of Chemical Industry, among them acids, salts and alkalies, artificial fertilizers, explosives, aluminum compounds, mineral oils, dry distillation, the industries of coloring matters and colors, fats, oils, rubber and gutta-percha; a bibliography of German publications of technical hand- and text-books, a list of some technical journals, and a carefully prepared subject-index, conclude the volume.

A liberal introduction of tables of export and import of many of the chemical substances discussed permit an interesting study of the conditions of various trades in different countries, and at different times. Naturally, German conditions receive by far the largest share of attention, but it can not be said that the trade conditions of other countries have been neglected.

The different topics of child labor, working men's insurance, laws and regulations of hygiene in different industries, all receive consideration and the treatment of the various topics throughout shows an intimate acquaintance with the data and statistics of the subjects discussed.

The statistics generally include those of the year 1907, and are thus well up to date. Prices,

when they are quoted, seem to be given with scrupulous care, in illustration of which it may be remarked that the author quotes the price paid for matches in the United States per thousand, not boxed, and per gross of boxes containing 100 matches each.

The style in which the book is written is pleasant and lucid and, in general, the sense of proportion is well maintained. It does, however, seem strange that no mention whatever should have been made of the Sugar Industry, certainly one of the leading industries of the present day, when the author has found it desirable to refer to the industry of condensed gases, and to that of calcium carbide and acetylene gas, in some detail.

The paper and print are of the usual excellence of the Teubner publications.

F. G. WIECHMANN

Schoenichen-Kalberlah. B. Eyferth's Einfachste Lebensformen des Tier- und Pflanzenreiches. Naturgeschichte der mikroskopischen Süsswasserbewohner. Vierte, vielfach verbesserte und erweiterte Auflage von Dr. WALTHER SCHOENICHEN. Mit über 700 Abbildungen auf 16 Tafeln in Lichtdruck nach Zeichnungen von Dr. A. KALBERLAH. Zahlreichen Abbildungen im Text und 2 Portraits. Braunschweig, Verlag von B. Goeritz. 1909. M. 23.60.

The fourth edition of Eyferth's "Einfachste Lebensformen" from the hands of Dr. Schoenichen brings up to date this old favorite of the amateur microscopist. The work is, however, somewhat more than a popular treatise on the microscopic life of fresh water, being a carefully worked out systematic manual of about 1,700 species. It covers the minute plant life quite completely and includes the Protozoa, Rotifera and Gastrotricha on the animal side. It is to be regretted, in the matter of completeness, that the remaining animal groups of fresh water, at least the Entomostraca, Nematoda, Annelida and Turbellaria, were not added in this revision. Such additions would very greatly enhance the usefulness of the work and might still permit its compass in a single volume. The excellent heliotype plates with their 700 figures from original sources such as Cohn, Fischer, Naegeli, Kirchner, Hansgirg, Rabenhorst, Wille, Van Huerck, Smith, Leidy, Schulze, Penard, Senn, Stein, Klebs, Schewiakoff, Hudson and Gosse and Weber afford a wealth and range of illustration rarely attained in inexpensive manuals. The great reduction in size has resulted in some loss of detail in the case of the plates of the Ciliata, but on the whole it has been adequately preserved elsewhere.

The fourth edition has been enlarged by a complete revision of the Chlorophyceæ, Mastigophora and Rhizopoda and many minor additions in other groups involving the insertion of a considerable number of text figures.

The introductory chapter deals with the œcology of the microscopic life of fresh water, its occurrence and distribution, methods of collection, examination and preservation, and the biological examination of potable waters. The last topic is, however, very inadequately treated, judged by the criteria of the sanitary engineer.

A few errors are to be found in the book; *e. g.*, the genus *Pleodorina* should be assigned to Shaw, and the plates of *Ceratium* are incorrectly described and figured.

There are also some noticeable omissions in the references to important literature, as, for example, the failure to mention the *Archiv for Protistenkunde* and under algæ the omission of West's "Desmids," Penard's "Dinoflagellata," of Chodat's and of Lemmermann's compendiums of Swiss and Brandenburg algæ. Sand's monograph of the Suctoria is not noted. No reference is made to Rousselet's methods for rotifers nor of Jennings's indispensable contributions to the more difficult families of this group.

The index is ample and accurate and the various organisms are, in part at least, classified here by a set of symbols according to their associations and œcological relations as polysaprobs, strong or weak mesosaprobs and oligosaprobs, after the conclusions of Kolkwitz and Marsson.

The book is a useful addition to the library of the laboratory, the water analyst and the amateur microscopist. CHARLES A. KOFOID
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Habit-Formation and the Science of Education. By STUART H. ROWE, Head of the Department of Psychology and Principles of Education in the Brooklyn Training School for Teachers, and Lecturer on Educational Psychology in Adelphi College, Brooklyn, New York. Pp. xvii + 300. New York, Longmans, Green & Co. 1909.

Educational doctrines, so far as they find expression in school practise, have been unseemly erratic. This is due to the fact that the scientific method has never been employed in solving school problems. Education is still an art, managed pretty successfully by those whose instincts are adapted to it, but wretchedly bungled by all others. The schools, like other social institutions, have followed the line of least resistance. During the colonial period, when the body of knowledge was comparatively small, when books were few, and society less complex, children were thoroughly drilled in the few subjects which they studied. With the rapid growth in knowledge and in the industries, during the latter part of the nineteenth century, new demands were made upon the schools. The three R's no longer met the social needs, and, with the enlargement of the curriculum, the drill master disappeared. The unscientific feature in this change is the entire absence of accurate analysis of the problem. A method that has been followed is not necessarily bad because of its age, nor is the new, because of its youth, good. It is this uncritical, mad dash from one method to another, during a time of prevailing scientific investigation, that has brought education into disrepute. Any book, therefore, that critically examines one of the educational problems, is a contribution to education. And this is what Rowe's "Habit-Formation" does. The teacher, Rowe maintains, interferes too much in the learning process of her pupils. She neglects "all the automatic (both natural and acquired) ways of learning which the child has, and insists that he work out everything systematically and under guidance." This is not only a useless waste of teaching energy, but, in addition, it disturbs the course of development. Every child has his own way of responding to his environment, because of his organic structure, and forced departure from this individual mode of reacting must be decided upon only after the most careful examination of the situation. Motor, visual and auditory minded children illustrate the need of care. Rowe discusses the manner in which experience is organized, and emphasizes the distinction between habits and ideas. "Determine whether the habit is an automatism which will be hit upon by the child as a result of his own initiative and experimental efforts, or implies a definite idea which must first appear in consciousness before it can be transformed into a fixed automatic process." In other words, the teacher is to adapt herself to the situation. She is to "analyze the subject-matter and determine what elements in it are to become habitual." The way in which habits are established, the manner of securing practise, and the method of evoking initiative, are treated in separate chapters. Initiative is to be developed through appeals to the instinctive activities, the emotions, and to specialized motives. Appeals to the child's reason are appeals *through* reason to his instincts, emotions or motives. Practise is to be secured by making "all the conditions such that the reaction will take place as naturally as possible." Teachers have been too willing to work against the resistance of the instincts and emotions. This is because, at the outset, it is the line of least resistance, and failure to analyze the situation causes them to overlook the fact that later it becomes the line of greatest resistance. One of the purposes of education is to establish mental attitudes toward the various subjects of study and toward work in general, and Rowe deals at length with the various kinds of drill in relation to this purpose. The difficulty with the book for teachers who are unskilled in psychology is that it lacks concreteness. Illustrative examples are not as numerous as they should be, but this is a less serious objection

than it would have been a few years ago, and altogether the book is a valuable contribution to the science of education. A useful bibliography is appended.

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NOTES ON THE TEACHING OF ZOOLOGY AND PLANS FOR ITS IMPROVEMENT

Few Elect Zoology.—Although for some time the writer has been under the impression that a good many more students elect botany than zoology, both in the high schools and academies and in the college; yet in glancing over our (Kansas) "High School Manual"[1] I was somewhat surprised to find that almost *eight* times as many high school pupils were last year enrolled in botany as in zoology—to be exact, 2,669 in botany and 346 in zoology. Another table in this manual reveals the fact that while 177 of the accredited high schools claim to be equipped for botany, but 33 claim any equipment for zoology, and the latter is usually estimated at a lesser value. I can quote figures from one other state only. In Minnesota,[2] starting with a ratio of 4 to 1 in 1894, zoology has steadily gained till last year it stood 9 to 7 in favor of botany. The fact that neither St. Louis, Mo., nor Tacoma, Wash., offers any zoology in its high schools leads me to suspect that similar disproportion exists in other states, at least in the middle and far west.

We teachers of zoology can not avoid asking, Why is this so? It is surely not because animals with their free movements and their intelligence are less interesting than plants. Where is the child or grown-up (aside from the specialist) who will not leave the prettiest bed of flowers to watch the cage of playful monkeys? The moving object, particularly the automatically moving one, attracts all of us. Nor can it be that the school authorities regard zoology as less practical than botany. To know the ravaging insect is just as important as to recognize the medicinal plant. To name the brilliant song bird properly is just as desirable as to classify the fragrant flower.

According to my thinking, at least three causes can be cited which operate to bring about such a disproportion between the subjects.

The first one is the lack of properly prepared teachers. Few of the instructors in the high schools are prepared to teach either of the two sciences. When called upon to teach one, a majority will choose botany instead of zoology. They probably had a course in elementary botany and not in zoology. Besides, plants are simpler and they feel that they can manage a course concerning them better than the more complex and larger group of animals.

A second and probably a more potent cause is the fact that many of our children are taught by their parents from early childhood to avoid and fear the animals—the creepy worms, the biting spiders and the dreadful mice. In "nature study" in the grade schools (taught by women) this view of the animals is farther inculcated. As a result, when the young people get into the high school and are to select a biological science they naturally choose botany.

The third cause is a greater one, at least a more real one. It is the difficulty of securing plenty of good material for the course in zoology. While the botanist has all his important phyla represented in almost any inland region, the zoologist has three important phyla practically limited to salt water. This necessitates the securing of a good deal of material from the seashore. And of the material that is in the vicinity it is so much easier for the botanist to secure what he wants—to pick the flower on the bank of the brook than to catch the cray-fish in the dirty water. The flower will surely be found on the first "tramp," provided it is made at the right time and to the right place. To secure the cray-fish, in addition to choosing the right season and the proper locality, the necessary seine or other paraphernalia to catch the desired specimen must be taken along. Sometimes it means the employment of help to handle the apparatus. To secure some species requires a different set of tools, and they are even harder to get than

[1] *Bulletin of the University of Kansas*, 1908.

[2] Fifteenth Annual Report of the Inspector of the State High Schools. State of Minnesota, 1908.